



US-162
SEQUENCE LISTING

<110> Yumi Matsuzaki, Jun Nakamura and Kenichi Hashiguchi
<120> Method for producing L-arginine or L-lysine by fermentation
<130> US-162
<140> US/10/790,224
<141> 2004-03-02
<150> JP 2003-056129
<151> 2003-03-03
<160> 24
<170> PatentIn Ver. 2.0

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<210> 15

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<222> (1852)..(2364)

<400> 15

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Met Ser
1

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5 10 15
act gca cgc caa gct ctc att ttg cag att ttg gac aaa caa aaa gtc 1953

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atc	acc	cag	gcc	acc	ttg	tcc	cgg	gat	ctc	gat	gaa	ctc	ggg	gca	cgc	2049
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<210> 16

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<212> PRT

<213> *Brevibacterium flavum*

<400> 16

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Lys Val Thr Ser Gln Val Gln Leu Ser Glu Leu Leu Asp Glu Gly
 35          40          45
Ile Asp Ile Thr Gln Ala Thr Leu Ser Arg Asp Leu Asp Glu Leu Gly
 50          55          60
Ala Arg Lys Val Arg Pro Asp Gly Gly Arg Ala Tyr Tyr Ala Val Gly
 65          70          75          80
Pro Val Asp Ser Ile Ala Arg Glu Asp Leu Arg Gly Pro Ser Glu Lys
          85          90          95
Leu Arg Arg Met Leu Asp Glu Leu Leu Val Ser Thr Asp His Ser Gly
100          105          110
Asn Ile Ala Met Leu Arg Thr Pro Pro Gly Ala Ala Gln Tyr Leu Ala
115          120          125
Ser Phe Ile Asp Arg Val Gly Leu Lys Glu Val Val Gly Thr Ile Ala
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<210> 17

<211> 3138

<212> DNA

<213> *Brevibacterium lactofermentum*

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<221> CDS

<222> (1)..(3138)

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Asp Pro Leu Pro Lys Val Gly Ser Leu Ser Leu Lys Ser Glu His Ala
          20          25          30
caa gca gat cta gag cat ttg ggt tgg cgc aat gtt gag tct ttg gat 144
Gln Ala Asp Leu Glu His Leu Gly Trp Arg Asn Val Glu Ser Leu Asp
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ttg ttg tgg ggc ttg tca ggt gca ggc gat ccc gat gtc gcg ctg aac 192

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aac	tct	gtg	gtc	aac	ttg	agc	gcg	gat	gcc	atc	aga	ttg	tct	ccg	gat	1632
Asn	Ser	Val	Val	Asn	Leu	Ser	Ala	Asp	Ala	Ile	Arg	Leu	Ser	Pro	Asp	
gct	gca	aag	cta	caa	ttg	ggg	gca	ttg	gga	tac	ctg	cat	cca	tca	cgt	1680
Ala	Ala	Lys	Leu	Gln	Leu	Gly	Ala	Leu	Gly	Tyr	Leu	His	Pro	Ser	Arg	
															560	
gct	tat	gaa	cac	ctg	act	gct	ctt	gca	tca	gga	gct	agc	cgt	aaa	gcc	1728
Ala	Tyr	Glu	His	Leu	Thr	Ala	Leu	Ala	Ser	Gly	Ala	Ser	Arg	Lys	Ala	
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aag	att	cag	gcg	atg	ttg	ctg	ccc	acg	ttg	atg	gag	tgg	ctg	tct	caa	1776
Lys	Ile	Gln	Ala	Met	Leu	Leu	Pro	Thr	Leu	Met	Glu	Trp	Leu	Ser	Gln	
aca	gct	gaa	cca	gat	gcg	gga	ttg	ctg	aat	tac	cgc	aag	ctt	tct	gat	1824
Thr	Ala	Glu	Pro	Asp	Ala	Gly	Leu	Leu	Asn	Tyr	Arg	Lys	Leu	Ser	Asp	
gct	tcc	tat	gat	cgc	agc	tgg	ttt	ttg	cgc	atg	ctg	cgt	gat	gag	ggc	1872
Ala	Ser	Tyr	Asp	Arg	Ser	Trp	Phe	Leu	Arg	Met	Leu	Arg	Asp	Glu	Gly	
gta	gtg	ggg	cag	cgg	ttg	atg	cgt	att	ttg	gga	aat	tct	ccc	tat	att	1920
Val	Val	Gly	Gln	Arg	Leu	Met	Arg	Ile	Leu	Gly	Asn	Ser	Pro	Tyr	Ile	

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gcg Ala	gcg Ala	tct Ser	ggt Gly 660	cct Pro	aaa Lys	ttg Leu	ctt Leu	gct Ala 665	act Thr	gca Ala	ccg Pro	act Thr	cag Gln 670	ggt Val	gtg Val	2016
aaa Lys	gca Ala	atc Ile 675	aag Lys	gcg Ala	acg Thr	gtg Val	tcg Ser 680	cgt Arg	cat His	gag Glu	tca Ser	cct Pro 685	gat Asp	cgg Arg	gcg Ala	2064
atc Ile	cag Gln 690	gct Ala	gca Ala	cga Arg	tcg Ser	ctg Leu 695	agg Arg	agg Arg	cag Gln	gag Glu	ctg Leu 700	gca Ala	cgc Arg	att Ile	gcc Ala	2112
tct Ser 705	gct Ala	gat Asp	ttg Leu	ctc Leu	aac Asn 710	atg Met	ctc Leu	act Thr	gtt Val	cag Gln 715	gaa Glu	gta Val	tgc Cys	caa Gln	agc Ser 720	2160
ttg Leu	tca Ser	cta Leu	gtc Val	tgg Trp 725	gat Asp	gcg Ala	gtg Val	ttg Leu	gat Asp 730	gct Ala	gcc Ala	ttg Leu	gat Asp	gcg Ala 735	gaa Glu	2208
atc Ile	cgt Arg	gct Ala	gca Ala 740	ctt Leu	aac Asn	gat Asp	cca Pro	cag Gln 745	aaa Lys	cca Pro	gat Asp	cag Gln	cct Pro 750	ctg Leu	gcc Ala	2256
aat Asn	att Ile	tct Ser 755	gtg Val	atc Ile	ggc Gly	atg Met	ggc Gly 760	cgt Arg	ttg Leu	ggt Gly	gga Gly	gca Ala 765	gaa Glu	ctt Leu	gga Gly	2304
tac Tyr	ggt Gly 770	tct Ser	gat Asp	gcc Ala	gat Asp	gtg Val 775	atg Met	ttt Phe	gta Val	tgc Cys	gag Glu 780	ccg Pro	gta Val	gcc Ala	ggt Gly	2352
gtg Val 785	gaa Glu	gag Glu	cat His	gag Glu	gcc Ala 790	gtc Val	aca Thr	tgg Trp	tct Ser	att Ile 795	gcg Ala	atc Ile	tgt Cys	gat Asp	tcc Ser 800	2400
atg Met	cgg Arg	tcg Ser	agg Arg	ctt Leu 805	gcg Ala	cag Gln	cct Pro	tcc Ser	ggt Gly 810	gat Asp	cca Pro	cct Pro	ttg Leu	gag Glu 815	gtg Val	2448
gat Asp	ctg Leu	ggg Gly	ctg Leu 820	cgt Arg	cct Pro	gaa Glu	ggg Gly	aga Arg 825	tct Ser	ggt Gly	gcg Ala	att Ile	gtg Val 830	cgc Arg	acc Thr	2496
gtt Val	gat Asp	tcc Ser 835	tat Tyr	gtg Val	aag Lys	tac Tyr	tac Tyr 840	gaa Glu	aag Lys	tgg Trp	ggt Gly	gaa Glu 845	act Thr	tgg Trp	gag Glu	2544
att Ile	cag Gln 850	gcg Ala	ctg Leu	ctg Leu	agg Arg	gct Ala 855	gcg Ala	tgg Trp	gtt Val	gct Ala	ggt Gly 860	gat Asp	cgt Arg	gag Glu	ctg Leu	2592
ggc Gly 865	att Ile	aag Lys	ttc Phe	ttg Leu	gag Glu 870	tcg Ser	att Ile	gat Asp	cgt Arg	ttc Phe 875	cgc Arg	tac Tyr	cca Pro	gtt Val	gac Asp 880	2640
ggg Gly	gca Ala	acg Thr	cag Gln	gcg Ala 885	cag Gln	ctt Leu	cgt Arg	gaa Glu 890	gtt Val	cgt Arg	cga Arg	att Ile	aag Lys	gcg Ala 895	agg Arg	2688
gtg Val	gat Asp	aat Asn	gag Glu 900	agg Arg	ctt Leu	ccg Pro	cgc Arg	ggg Gly 905	gct Ala	gat Asp	cga Arg	aat Asn	acc Thr 910	cat His	acc Thr	2736
aag Lys	ctg Leu	ggt Gly 915	cgg Arg	gga Gly	gcg Ala	tta Leu	act Thr 920	gac Asp	atc Ile	gag Glu	tgg Trp	act Thr 925	gtg Val	cag Gln	ttg Leu	2784
ttg Leu	acc Ala	atg Ala	atg Ala	cat Ala	gct Ala	cat Ala	gag Ala	att Ala	ccg Ala	gag Ala	ctg Ala	cac Ala	aat Ala	acg Ala	tcg Ala	2832

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Leu	Thr	Met	Met	His	Ala	His	Glu	Ile	Pro	Glu	Leu	His	Asn	Thr	Ser		
930						935					940						
acg	ttg	gaa	gtt	ctt	gaa	gtg	ctg	gaa	aag	cat	cag	att	att	aac	cct	2880	
Thr	Leu	Glu	Val	Leu	Glu	Val	Leu	Glu	Lys	His	Gln	Ile	Ile	Asn	Pro		
945					950					955					960		
gtg	cag	gtg	cag	acg	ctt	cgg	gaa	gcg	tgg	ctg	acg	gca	acg	gct	gct	2928	
Val	Gln	Val	Gln	Thr	Leu	Arg	Glu	Ala	Trp	Leu	Thr	Ala	Thr	Ala	Ala		
				965					970					975			
agg	aat	gcg	ctt	gtg	ctg	gtc	agg	ggg	aag	aga	tta	gat	cag	tta	cct	2976	
Arg	Asn	Ala	Leu	Val	Leu	Val	Arg	Gly	Lys	Arg	Leu	Asp	Gln	Leu	Pro		
			980					985					990				
act	cct	ggg	ccg	cac	ctt	gcg	cag	gtg	gct	ggg	gcg	tct	ggg	tgg	gat	3024	
Thr	Pro	Gly	Pro	His	Leu	Ala	Gln	Val	Ala	Gly	Ala	Ser	Gly	Trp	Asp		
		995					1000					1005					
cca	aat	gag	tac	cag	gag	tat	ttg	gaa	aac	tat	ctg	aaa	gtg	acc	agg	3072	
Pro	Asn	Glu	Tyr	Gln	Glu	Tyr	Leu	Glu	Asn	Tyr	Leu	Lys	Val	Thr	Arg		
	1010					1015					1020						
aag	agt	cgt	cag	gtt	gtt	gat	gaa	gtc	ttc	tgg	ggg	gtg	gac	tct	atg	3120	
Lys	Ser	Arg	Gln	Val	Val	Asp	Glu	Val	Phe	Trp	Gly	Val	Asp	Ser	Met		
1025					1030					1035					1040		
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Glu	Gln	Arg	Glu	Phe													
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<210> 18
 <211> 1045
 <212> PRT
 <213> Brevibacterium lactofermentum

<400> 18

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Asp	Pro	Leu	Pro	Lys	Val	Gly	Ser	Leu	Ser	Leu	Lys	Ser	Glu	His	Ala		
			20					25					30				
Gln	Ala	Asp	Leu	Glu	His	Leu	Gly	Trp	Arg	Asn	Val	Glu	Ser	Leu	Asp		
		35					40					45					
Leu	Leu	Trp	Gly	Leu	Ser	Gly	Ala	Gly	Asp	Pro	Asp	Val	Ala	Leu	Asn		
		50				55					60						
Leu	Leu	Ile	Arg	Leu	Tyr	Gln	Ala	Leu	Glu	Ala	Ile	Gly	Glu	Asp	Ala		
65				70					75					80			
Arg	Asn	Glu	Leu	Asp	Gln	Glu	Ile	Arg	Gln	Asp	Glu	Glu	Leu	Arg	Val		
				85					90					95			
Arg	Leu	Phe	Ala	Leu	Leu	Gly	Gly	Ser	Ser	Ala	Val	Gly	Asp	His	Leu		
			100					105					110				
Val	Ala	Asn	Pro	Leu	Gln	Trp	Lys	Leu	Leu	Lys	Leu	Asp	Ala	Pro	Ser		
		115					120					125					
Arg	Glu	Glu	Met	Phe	Gln	Ala	Leu	Leu	Glu	Ser	Val	Lys	Ala	Gln	Pro		
	130					135					140						
Ala	Val	Leu	Glu	Val	Glu	Asp	Phe	Ser	Asp	Ala	His	Asn	Ile	Ala	Arg		
145					150				155					160			
Asp	Asp	Leu	Ser	Thr	Pro	Gly	Phe	Tyr	Thr	Ala	Ser	Val	Thr	Gly	Pro		
				165					170					175			
Glu	Ala	Glu	Arg	Val	Leu	Lys	Trp	Thr	Tyr	Arg	Thr	Leu	Leu	Thr	Arg		
			180					185					190				
Ile	Ala	Ala	His	Asp	Leu	Ala	Gly	Thr	Tyr	Pro	Thr	Asp	Met	Arg	Arg		

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		195				200					205				
Lys	Gly	Gly	Asp	Pro	Val	Pro	Phe	Ser	Thr	Val	Thr	Met	Gln	Leu	Ser
	210					215					220				
Asp	Leu	Ala	Asp	Ala	Ala	Leu	Thr	Ala	Ala	Leu	Ala	Val	Ala	Ile	Ala
225					230					235				240	
Asn	Val	Tyr	Gly	Glu	Lys	Pro	Val	Asp	Ser	Ala	Leu	Ser	Val	Ile	Ala
			245						250					255	
Met	Gly	Lys	Cys	Gly	Ala	Gln	Glu	Leu	Asn	Tyr	Ile	Ser	Asp	Val	Asp
		260						265					270		
Val	Val	Phe	Val	Ala	Glu	Pro	Ala	Asn	Ser	Lys	Ser	Thr	Arg	Thr	Ala
		275					280						285		
Ala	Glu	Leu	Ile	Arg	Ile	Gly	Ser	Asn	Ser	Phe	Phe	Glu	Val	Asp	Ala
	290					295					300				
Ala	Leu	Arg	Pro	Glu	Gly	Lys	Ser	Gly	Ala	Leu	Val	Arg	Ser	Leu	Asp
305					310					315					320
Ser	His	Met	Ala	Tyr	Tyr	Lys	Arg	Trp	Ala	Glu	Thr	Trp	Glu	Phe	Gln
				325					330					335	
Ala	Leu	Leu	Lys	Ala	Arg	Pro	Met	Thr	Gly	Asp	Ile	Asp	Leu	Gly	Gln
			340					345					350		
Ser	Tyr	Val	Asp	Ala	Leu	Ser	Pro	Leu	Ile	Trp	Ala	Ala	Ser	Gln	Arg
		355					360					365			
Glu	Ser	Phe	Val	Thr	Asp	Val	Gln	Ala	Met	Arg	Arg	Arg	Val	Leu	Asp
	370					375					380				
Asn	Val	Pro	Glu	Asp	Leu	Arg	Asp	Arg	Glu	Leu	Lys	Leu	Gly	Arg	Gly
385					390					395					400
Gly	Leu	Arg	Asp	Val	Glu	Phe	Ala	Val	Gln	Leu	Leu	Gln	Met	Val	His
			405						410					415	
Gly	Arg	Ile	Asp	Glu	Thr	Leu	Arg	Val	Arg	Ser	Thr	Val	Asn	Ala	Leu
			420					425					430		
His	Val	Leu	Val	Asp	Gln	Gly	Tyr	Val	Gly	Arg	Glu	Asp	Gly	His	Asn
		435					440					445			
Leu	Ile	Glu	Ser	Tyr	Glu	Phe	Leu	Arg	Leu	Leu	Glu	His	Arg	Leu	Gln
	450					455					460				
Leu	Glu	Arg	Ile	Lys	Arg	Thr	His	Leu	Leu	Pro	Lys	Pro	Asp	Asp	Arg
					470					475					480
Met	Asn	Met	Arg	Trp	Leu	Ala	Arg	Ala	Ser	Gly	Phe	Thr	Gly	Ser	Met
				485					490					495	
Glu	Gln	Ser	Ser	Ala	Lys	Ala	Met	Glu	Arg	His	Leu	Arg	Lys	Val	Arg
			500					505					510		
Leu	Gln	Ile	Gln	Ser	Leu	His	Ser	Gln	Leu	Phe	Tyr	Arg	Pro	Leu	Leu
		515					520					525			
Asn	Ser	Val	Val	Asn	Leu	Ser	Ala	Asp	Ala	Ile	Arg	Leu	Ser	Pro	Asp
	530					535					540				
Ala	Ala	Lys	Leu	Gln	Leu	Gly	Ala	Leu	Gly	Tyr	Leu	His	Pro	Ser	Arg
545					550					555					560
Ala	Tyr	Glu	His	Leu	Thr	Ala	Leu	Ala	Ser	Gly	Ala	Ser	Arg	Lys	Ala
				565					570					575	
Lys	Ile	Gln	Ala	Met	Leu	Leu	Pro	Thr	Leu	Met	Glu	Trp	Leu	Ser	Gln
			580					585					590		
Thr	Ala	Glu	Pro	Asp	Ala	Gly	Leu	Leu	Asn	Tyr	Arg	Lys	Leu	Ser	Asp
		595					600					605			
Ala	Ser	Tyr	Asp	Arg	Ser	Trp	Phe	Leu	Arg	Met	Leu	Arg	Asp	Glu	Gly
	610					615					620				
Val	Val	Gly	Gln	Arg	Leu	Met	Arg	Ile	Leu	Gly	Asn	Ser	Pro	Tyr	Ile
625					630					635					640

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Ser	Glu	Leu	Ile	Ile	Ser	Thr	Pro	Asp	Phe	Val	Lys	Gln	Leu	Gly	Asp
				645					650					655	
Ala	Ala	Ser	Gly	Pro	Lys	Leu	Leu	Ala	Thr	Ala	Pro	Thr	Gln	Val	Val
			660					665					670		
Lys	Ala	Ile	Lys	Ala	Thr	Val	Ser	Arg	His	Glu	Ser	Pro	Asp	Arg	Ala
		675					680					685			
Ile	Gln	Ala	Ala	Arg	Ser	Leu	Arg	Arg	Gln	Glu	Leu	Ala	Arg	Ile	Ala
	690					695					700				
Ser	Ala	Asp	Leu	Leu	Asn	Met	Leu	Thr	Val	Gln	Glu	Val	Cys	Gln	Ser
705					710					715					720
Leu	Ser	Leu	Val	Trp	Asp	Ala	Val	Leu	Asp	Ala	Ala	Leu	Asp	Ala	Glu
				725					730					735	
Ile	Arg	Ala	Ala	Leu	Asn	Asp	Pro	Gln	Lys	Pro	Asp	Gln	Pro	Leu	Ala
			740					745					750		
Asn	Ile	Ser	Val	Ile	Gly	Met	Gly	Arg	Leu	Gly	Gly	Ala	Glu	Leu	Gly
		755				760						765			
Tyr	Gly	Ser	Asp	Ala	Asp	Val	Met	Phe	Val	Cys	Glu	Pro	Val	Ala	Gly
	770				775						780				
Val	Glu	Glu	His	Glu	Ala	Val	Thr	Trp	Ser	Ile	Ala	Ile	Cys	Asp	Ser
785					790					795					800
Met	Arg	Ser	Arg	Leu	Ala	Gln	Pro	Ser	Gly	Asp	Pro	Pro	Leu	Glu	Val
				805					810					815	
Asp	Leu	Gly	Leu	Arg	Pro	Glu	Gly	Arg	Ser	Gly	Ala	Ile	Val	Arg	Thr
			820					825					830		
Val	Asp	Ser	Tyr	Val	Lys	Tyr	Tyr	Glu	Lys	Trp	Gly	Glu	Thr	Trp	Glu
		835					840					845			
Ile	Gln	Ala	Leu	Leu	Arg	Ala	Ala	Trp	Val	Ala	Gly	Asp	Arg	Glu	Leu
	850					855					860				
Gly	Ile	Lys	Phe	Leu	Glu	Ser	Ile	Asp	Arg	Phe	Arg	Tyr	Pro	Val	Asp
865					870					875					880
Gly	Ala	Thr	Gln	Ala	Gln	Leu	Arg	Glu	Val	Arg	Arg	Ile	Lys	Ala	Arg
				885					890					895	
Val	Asp	Asn	Glu	Arg	Leu	Pro	Arg	Gly	Ala	Asp	Arg	Asn	Thr	His	Thr
			900					905					910		
Lys	Leu	Gly	Arg	Gly	Ala	Leu	Thr	Asp	Ile	Glu	Trp	Thr	Val	Gln	Leu
		915					920					925			
Leu	Thr	Met	Met	His	Ala	His	Glu	Ile	Pro	Glu	Leu	His	Asn	Thr	Ser
	930					935						940			
Thr	Leu	Glu	Val	Leu	Glu	Val	Leu	Glu	Lys	His	Gln	Ile	Ile	Asn	Pro
945					950					955					960
Val	Gln	Val	Gln	Thr	Leu	Arg	Glu	Ala	Trp	Leu	Thr	Ala	Thr	Ala	Ala
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Arg	Asn	Ala	Leu	Val	Leu	Val	Arg	Gly	Lys	Arg	Leu	Asp	Gln	Leu	Pro
			980					985					990		
Thr	Pro	Gly	Pro	His	Leu	Ala	Gln	Val	Ala	Gly	Ala	Ser	Gly	Trp	Asp
		995					1000					1005			
Pro	Asn	Glu	Tyr	Gln	Glu	Tyr	Leu	Glu	Asn	Tyr	Leu	Lys	Val	Thr	Arg
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Lys	Ser	Arg	Gln	Val	Val	Asp	Glu	Val	Phe	Trp	Gly	Val	Asp	Ser	Met
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Glu	Gln	Arg	Glu	Phe											
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<210> 19

<211> 1434

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<212> DNA

<213> Brevibacterium lactofermentum

<220>

<221> CDS

<222> (1)..(1434)

<400> 19

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Asn	Val	Glu	Phe	Val	Asp	Val	Arg	Phe	Thr	Asp	Leu	Pro	Gly	Thr	Glu	
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Gln	His	Phe	Ser	Ile	Pro	Ala	Ala	Ser	Phe	Asp	Ala	Asp	Thr	Val	Glu	
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gaa	ggt	ctc	gca	ttc	gac	gga	tcc	tcg	atc	cgt	ggc	ttc	acc	acg	atc	192
Glu	Gly	Leu	Ala	Phe	Asp	Gly	Ser	Ser	Ile	Arg	Gly	Phe	Thr	Thr	Ile	
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gac	gaa	tct	gac	atg	aat	ctc	ctg	cca	gac	ctc	gga	acg	gcc	acc	ctt	240
Asp	Glu	Ser	Asp	Met	Asn	Leu	Leu	Pro	Asp	Leu	Gly	Thr	Ala	Thr	Leu	
	65				70					75					80	
gat	cca	ttc	cgc	aag	gca	aag	acc	ctg	aac	gtt	aag	ttc	ttc	gtt	cac	288
Asp	Pro	Phe	Arg	Lys	Ala	Lys	Thr	Leu	Asn	Val	Lys	Phe	Phe	Val	His	
				85					90					95		
gat	cct	ttc	acc	cgc	gag	gca	ttc	tcc	cgc	gac	cca	cgc	aac	gta	gca	336
Asp	Pro	Phe	Thr	Arg	Glu	Ala	Phe	Ser	Arg	Asp	Pro	Arg	Asn	Val	Ala	
			100					105					110			
cgc	aag	gca	gag	cag	tac	ctg	gca	tcc	acc	ggc	att	gca	gac	acc	tgc	384
Arg	Lys	Ala	Glu	Gln	Tyr	Leu	Ala	Ser	Thr	Gly	Ile	Ala	Asp	Thr	Cys	
		115					120					125				
aac	ttc	ggc	gcc	gag	gct	gag	ttc	tac	ctc	ttc	gac	tcc	gtt	cgc	tac	432
Asn	Phe	Gly	Ala	Glu	Ala	Glu	Phe	Tyr	Leu	Phe	Asp	Ser	Val	Arg	Tyr	
	130					135					140					
tcc	acc	gag	atg	aac	tcc	ggc	ttc	tac	gaa	gta	gat	acc	gaa	gaa	ggc	480
Ser	Thr	Glu	Met	Asn	Ser	Gly	Phe	Tyr	Glu	Val	Asp	Thr	Glu	Glu	Gly	
	145				150					155					160	
tgg	tgg	aac	cgt	ggc	aag	gaa	acc	aac	ctc	gac	gga	acc	cca	aac	ctg	528
Trp	Trp	Asn	Arg	Gly	Lys	Glu	Thr	Asn	Leu	Asp	Gly	Thr	Pro	Asn	Leu	
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ggc	gca	aag	aac	cgc	gtc	aag	ggt	ggc	tac	ttc	cca	gta	gca	cca	tac	576
Gly	Ala	Lys	Asn	Arg	Val	Lys	Gly	Gly	Tyr	Phe	Pro	Val	Ala	Pro	Tyr	
			180					185					190			
gac	caa	acc	gtt	gac	gtg	cgc	gat	gac	atg	gtt	cgc	aac	ctc	gca	gct	624
Asp	Gln	Thr	Val	Asp	Val	Arg	Asp	Asp	Met	Val	Arg	Asn	Leu	Ala	Ala	
			195				200					205				
tcc	ggc	ttc	gct	ctt	gag	cgt	ttc	cac	cac	gaa	gtc	ggt	ggc	gga	cag	672
Ser	Gly	Phe	Ala	Leu	Glu	Arg	Phe	His	His	Glu	Val	Gly	Gly	Gly	Gln	
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cag	gaa	atc	aac	tac	cgc	ttc	aac	acc	atg	ctc	cac	gcg	gca	gat	gat	720
Gln	Glu	Ile	Asn	Tyr	Arg	Phe	Asn	Thr	Met	Leu	His	Ala	Ala	Asp	Asp	
	225				230					235					240	
atc	cag	acc	ttc	aag	tac	atc	atc	aag	aac	acc	gct	cgc	ctc	cac	ggc	768
Ile	Gln	Thr	Phe	Lys	Tyr	Ile	Ile	Lys	Asn	Thr	Ala	Arg	Leu	His	Gly	

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aag gct gca acc ttc atg cct aag cca ctg gct ggc gac aac ggt tcc	245	250	255	816
Lys Ala Ala Thr Phe Met Pro Lys Pro Leu Ala Gly Asp Asn Gly Ser	260	265	270	
ggc atg cac gct cac cag tcc ctc tgg aag gac ggc aag cca ctc ttc	275	280	285	864
Gly Met His Ala His Gln Ser Leu Trp Lys Asp Gly Lys Pro Leu Phe	290	295	300	
cac gat gag tcc ggc tac gca ggc ctg tcc gac atc gcc cgc tac tac	305	310	315	912
His Asp Glu Ser Gly Tyr Ala Gly Leu Ser Asp Ile Ala Arg Tyr Tyr	325	330	335	
atc ggc ggc atc ctg cac cac gca ggc gct gtt ctg gcg ttc acc aac	340	345	350	960
Ile Gly Gly Ile Leu His Ala Gly Ala Val Leu Ala Phe Thr Asn	355	360	365	
gca acc ctg aac tcc tac cac cgt ctg gtt cca ggc ttc gag gct cca	370	375	380	1008
Ala Thr Leu Asn Ser Tyr His Arg Leu Val Pro Gly Phe Glu Ala Pro	385	390	395	
atc aac ctg gtg tac tca cag cgc aac cgt tcc gct gct gtc cgt atc	400	405	410	1056
Ile Asn Leu Val Tyr Ser Gln Arg Asn Arg Ser Ala Ala Val Arg Ile	415	420	425	
cca atc acc gga tcc aac cca aag gca aag cgc atc gaa ttc cgc gct	430	435	440	1104
Pro Ile Thr Gly Ser Asn Pro Lys Ala Lys Arg Ile Glu Phe Arg Ala	445	450	455	
cca gac cca tca ggc aac cca tac ctg ggc ttc gca gcg atg atg atg	460	465	470	1152
Pro Asp Pro Ser Gly Asn Pro Tyr Leu Gly Phe Ala Ala Met Met Met	475	480	485	
gcc ggc ctc gac ggc atc aag aac cgc atc gag cca cac gct cca gtg	490	495	500	1200
Ala Gly Leu Asp Gly Ile Lys Asn Arg Ile Glu Pro His Ala Pro Val	505	510	515	
gac aag gac ctc tac gaa ctg cca cca gag gaa gct gca tcc att cca	520	525	530	1248
Asp Lys Asp Leu Tyr Glu Leu Pro Pro Glu Glu Ala Ala Ser Ile Pro	535	540	545	
cag gca cca acc tcc ctg gaa gca tcc ctg aag gca ctg cag gaa gac	550	555	560	1296
Gln Ala Pro Thr Ser Leu Glu Ala Ser Leu Lys Ala Leu Gln Glu Asp	565	570	575	
acc gac ttc ctc acc gag tct gac gtc ttc acc gag gat ctc atc gag	580	585	590	1344
Thr Asp Phe Leu Thr Glu Ser Asp Val Phe Thr Glu Asp Leu Ile Glu	595	600	605	
gcg tac atc cag tac aag tac gac aac gag atc tcc cca gtt cgc ctg	610	615	620	1392
Ala Tyr Ile Gln Tyr Lys Tyr Asp Asn Glu Ile Ser Pro Val Arg Leu	625	630	635	
cgc cca acc ccg cag gaa ttc gaa ttg tac ttc gac tgc taa	640	645	650	1434
Arg Pro Thr Pro Gln Glu Phe Glu Leu Tyr Phe Asp Cys	655	660	665	

<210> 20
 <211> 477
 <212> PRT
 <213> Brevibacterium lactofermentum

<400> 20
 Val Ala Phe Glu Thr Pro Glu Glu Ile Val Lys Phe Ile Lys Asp Glu
 1 5 10 15
 Asn Val Glu Phe Val Asp Val Arg Phe Thr Asp Leu Pro Gly Thr Glu
 20 25 30
 Gln His Phe Ser Ile Pro Ala Ala Ser Phe Asp Ala Asp Thr Val Glu

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[illegible]

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<210> 21
 <211> 672
 <212> DNA
 <213> Brevibacterium lactofermentum

<220>
 <221> CDS
 <222> (1)..(669)

<400> 21
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 Met Ala Gly Ala Val Gly Arg Pro Arg Arg Ser Ala Pro Arg Arg Ala
 1 5 10 15
 ggc aag aat cct cgc gag gag att ctt gac gcc tct gct gag ctt ttc 96
 Gly Lys Asn Pro Arg Glu Glu Ile Leu Asp Ala Ser Ala Glu Leu Phe
 20 25 30
 acc cat caa ggc ttc gca aca acc tcc acg cat caa atc gct gat gcc 144
 Thr His Gln Gly Phe Ala Thr Thr Ser Thr His Gln Ile Ala Asp Ala
 35 40 45
 gtg gga atc cgc caa gcc tcg ctg tat tat cac ttc ccg tct aag acg 192
 Val Gly Ile Arg Gln Ala Ser Leu Tyr Tyr His Phe Pro Ser Lys Thr
 50 55 60
 gaa atc ttc ctc acc ctc ctg aaa tct acc gtc gag ccg tcc act gtg 240
 Glu Ile Phe Leu Thr Leu Leu Lys Ser Thr Val Glu Pro Ser Thr Val
 65 70 75 80
 ctc gcc gaa gac tta agc atc ctg gat gca gga cct gag atg cgc ctc 288
 Leu Ala Glu Asp Leu Ser Ile Leu Asp Ala Gly Pro Glu Met Arg Leu
 85 90 95
 tgg gca atc gtt gcc tcc gaa gtg cgt ctg ctg ctg tcc acc aag tgg 336
 Trp Ala Ile Val Ala Ser Glu Val Arg Leu Leu Leu Ser Thr Lys Trp
 100 105 110
 aac gtc ggt cgc ctg tac caa ctc ccc atc gtt ggt tct gaa gag ttc 384
 Asn Val Gly Arg Leu Tyr Gln Leu Pro Ile Val Gly Ser Glu Glu Phe
 115 120 125
 gcc gag tac cac agc cag cgc gaa gcc ctc acc aac atc ttc cgc gac 432
 Ala Glu Tyr His Ser Gln Arg Glu Ala Leu Thr Asn Ile Phe Arg Asp
 130 135 140
 ctc gcc acc gaa atc gtc ggt gac gac ccc cgc gca gaa ctc ccc ttc 480
 Leu Ala Thr Glu Ile Val Gly Asp Asp Pro Arg Ala Glu Leu Pro Phe
 145 150 155 160
 cac atc acc atg tcg gtg atc gaa atg cgt cgc aac gac ggc aag att 528
 His Ile Thr Met Ser Val Ile Glu Met Arg Arg Asn Asp Gly Lys Ile
 165 170 175
 cca agc ccg ctt tcc gca gac agc ctc ccg gag acc gca att atg ctt 576
 Pro Ser Pro Leu Ser Ala Asp Ser Leu Pro Glu Thr Ala Ile Met Leu
 180 185 190
 gcc gac gcc tcc ctc gcc gtc ctc ggc gcg tcg ctg ccc gcc gac cgg 624
 Ala Asp Ala Ser Leu Ala Val Leu Gly Ala Ser Leu Pro Ala Asp Arg
 195 200 205
 gtc gaa aaa acg ctt gaa cta atc aag cag gct gac gcg aaa taa cca 672
 Val Glu Lys Thr Leu Glu Leu Ile Lys Gln Ala Asp Ala Lys
 210 215 220

<210> 22

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<211> 222
 <212> PRT
 <213> Brevibacterium lactofermentum

<400> 22
 Met Ala Gly Ala Val Gly Arg Pro Arg Arg Ser Ala Pro Arg Arg Ala
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 Gly Lys Asn Pro Arg Glu Glu Ile Leu Asp Ala Ser Ala Glu Leu Phe
 20 25 30
 Thr His Gln Gly Phe Ala Thr Thr Ser Thr His Gln Ile Ala Asp Ala
 35 40 45
 Val Gly Ile Arg Gln Ala Ser Leu Tyr Tyr His Phe Pro Ser Lys Thr
 50 55 60
 Glu Ile Phe Leu Thr Leu Leu Lys Ser Thr Val Glu Pro Ser Thr Val
 65 70 75 80
 Leu Ala Glu Asp Leu Ser Ile Leu Asp Ala Gly Pro Glu Met Arg Leu
 85 90 95
 Trp Ala Ile Val Ala Ser Glu Val Arg Leu Leu Leu Ser Thr Lys Trp
 100 105 110
 Asn Val Gly Arg Leu Tyr Gln Leu Pro Ile Val Gly Ser Glu Glu Phe
 115 120 125
 Ala Glu Tyr His Ser Gln Arg Glu Ala Leu Thr Asn Ile Phe Arg Asp
 130 135 140
 Leu Ala Thr Glu Ile Val Gly Asp Asp Pro Arg Ala Glu Leu Pro Phe
 145 150 155 160
 His Ile Thr Met Ser Val Ile Glu Met Arg Arg Asn Asp Gly Lys Ile
 165 170 175
 Pro Ser Pro Leu Ser Ala Asp Ser Leu Pro Glu Thr Ala Ile Met Leu
 180 185 190
 Ala Asp Ala Ser Leu Ala Val Leu Gly Ala Ser Leu Pro Ala Asp Arg
 195 200 205
 Val Glu Lys Thr Leu Glu Leu Ile Lys Gln Ala Asp Ala Lys
 210 215 220

<210> 23
 <211> 2076
 <212> DNA
 <213> Brevibacterium lactofermentum

<220>
 <221> CDS
 <222> (1)..(2076)

<400> 23
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 Met Asn Asn Pro Ala Gln Leu Arg Gln Asp Thr Glu Lys Glu Val Leu
 1 5 10 15
 gcg ttg ctg ggc tct ttg gtt tta ccc gcc ggc acc gcg ctt gcc gcc 96
 Ala Leu Leu Gly Ser Leu Val Leu Pro Ala Gly Thr Ala Leu Ala Ala
 20 25 30
 acc gga tct ttg gcc agg tcc gaa ctc acg ccg tat tcc gat ttg gac 144
 Thr Gly Ser Leu Ala Arg Ser Glu Leu Thr Pro Tyr Ser Asp Leu Asp
 35 40 45
 ctc att ttg atc cat cca cca ggg gca acc ccg gat ggc gtg gag gat 192
 Leu Ile Leu Ile His Pro Pro Gly Ala Thr Pro Asp Gly Val Glu Asp

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50						55						60						
ttg	tgg	tac	ccg	att	tgg	gac	gca	aaa	aag	cgc	ctc	gac	tac	tcc	gtg	240		
Leu	Trp	Tyr	Pro	Ile	Trp	Asp	Ala	Lys	Lys	Arg	Leu	Asp	Tyr	Ser	Val			
65						70						75						80
cgc	acc	cca	gat	gag	tgc	gtg	gct	atg	att	tct	gcg	gat	tcc	act	gca	288		
Arg	Thr	Pro	Asp	Glu	Cys	Val	Ala	Met	Ile	Ser	Ala	Asp	Ser	Thr	Ala			
85						90						95						
gcc	ctt	gcc	atg	ctt	gac	ctg	cga	ttt	att	gct	ggc	gat	gag	gat	ctg	336		
Ala	Leu	Ala	Met	Leu	Asp	Leu	Arg	Phe	Ile	Ala	Gly	Asp	Glu	Asp	Leu			
100						105						110						
tgt	gcc	aaa	acg	cgc	cgg	cgc	atc	gtg	gag	aag	tgg	cgc	cag	gaa	ctc	384		
Cys	Ala	Lys	Thr	Arg	Arg	Arg	Ile	Val	Glu	Lys	Trp	Arg	Gln	Glu	Leu			
115						120						125						
aac	aaa	aac	ttc	gac	gcc	gtt	gtg	gac	acc	gcg	att	gcc	cgt	tgg	cgc	432		
Asn	Lys	Asn	Phe	Asp	Ala	Val	Val	Asp	Thr	Ala	Ile	Ala	Arg	Trp	Arg			
130						135						140						
cgc	tcc	gga	ccc	gtc	gtg	gca	atg	acg	cgg	cca	gat	ctt	aaa	cac	ggc	480		
Arg	Ser	Gly	Pro	Val	Val	Ala	Met	Thr	Arg	Pro	Asp	Leu	Lys	His	Gly			
145						150						155						160
agg	gga	ggg	ctg	cgc	gat	ttc	gaa	ctg	atc	aag	gcc	ctc	gcg	ctc	ggc	528		
Arg	Gly	Gly	Leu	Arg	Asp	Phe	Glu	Leu	Ile	Lys	Ala	Leu	Ala	Leu	Gly			
165						170						175						
cac	cta	tgc	aac	gtt	cca	cag	cta	gat	acg	caa	cac	cag	ctg	ctt	ctc	576		
His	Leu	Cys	Asn	Val	Pro	Gln	Leu	Asp	Thr	Gln	His	Gln	Leu	Leu	Leu			
180						185						190						
gac	gcc	cgc	acc	ttg	ctg	cac	gtc	cac	gcg	cga	cgc	tcc	cgc	gac	gtc	624		
Asp	Ala	Arg	Thr	Leu	Leu	His	Val	His	Ala	Arg	Arg	Ser	Arg	Asp	Val			
195						200						205						
ctt	gat	ccc	gaa	ttt	gcg	gtg	gat	gtg	gcc	atg	gat	ttg	ggc	ttt	gtt	672		
Leu	Asp	Pro	Glu	Phe	Ala	Val	Asp	Val	Ala	Met	Asp	Leu	Gly	Phe	Val			
210						215						220						
gac	cgc	tat	cac	tta	ggc	cgg	gag	atc	gcc	gat	gca	gcc	cgc	gcc	att	720		
Asp	Arg	Tyr	His	Leu	Gly	Arg	Glu	Ile	Ala	Asp	Ala	Ala	Arg	Ala	Ile			
225						230						235						240
gat	gac	ggc	ctg	acc	gcg	ctg	gcc	acc	gcc	cgt	ggc	att	ttg	cca		768		
Asp	Asp	Gly	Leu	Thr	Ala	Leu	Ala	Thr	Ala	Arg	Gly	Ile	Leu	Pro				
245						250						255						
cgt	cgc	acg	ggg	ttt	gct	ttt	agg	aat	gct	tct	cga	cgc	cca	ctt	gat	816		
Arg	Arg	Thr	Gly	Phe	Ala	Phe	Arg	Asn	Ala	Ser	Arg	Arg	Pro	Leu	Asp			
260						265						270						
ctt	gat	gtc	gtc	gac	gcc	aac	ggc	act	atc	gaa	ttg	tcc	aaa	aaa	cca	864		
Leu	Asp	Val	Val	Asp	Ala	Asn	Gly	Thr	Ile	Glu	Leu	Ser	Lys	Lys	Pro			
275						280						285						
gat	ctt	aat	gat	ccc	gca	ctt	cca	ctt	cga	gtg	gcc	gca	gcc	gca	gcg	912		
Asp	Leu	Asn	Asp	Pro	Ala	Leu	Pro	Leu	Arg	Val	Ala	Ala	Ala	Ala	Ala			
290						295						300						
acc	acc	gga	ctt	ccg	gtg	gca	gaa	tca	acc	tgg	gct	cga	ctt	aat	gaa	960		
Thr	Thr	Gly	Leu	Pro	Val	Ala	Glu	Ser	Thr	Trp	Ala	Arg	Leu	Asn	Glu			
305						310						315						320
tgc	ccg	cca	ctt	cct	gag	cca	tgg	cct	gcc	aat	gca	gca	ggg	gac	ttc	1008		
Cys	Pro	Pro	Leu	Pro	Glu	Pro	Trp	Pro	Ala	Asn	Ala	Ala	Gly	Asp	Phe			
325						330						335						
ttt	cgg	att	ctc	tcc	agt	ccg	aaa	aac	tca	cgc	cga	gtg	gtg	aaa	aat	1056		
Phe	Arg	Ile	Leu	Ser	Ser	Pro	Lys	Asn	Ser	Arg	Arg	Val	Val	Lys	Asn			
340						345						350						

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atg	gat	cgc	cac	gga	ttg	tgg	tcg	cgt	ttt	gtt	cca	gaa	tgg	gac	cgc	1104
Met	Asp	Arg	His	Gly	Leu	Trp	Ser	Arg	Phe	Val	Pro	Glu	Trp	Asp	Arg	
		355					360					365				
atc	aaa	ggg	ctt	atg	ccc	cgt	gaa	ccc	agc	cat	att	tcc	acc	atc	gat	1152
Ile	Lys	Gly	Leu	Met	Pro	Arg	Glu	Pro	Ser	His	Ile	Ser	Thr	Ile	Asp	
	370					375					380					
gaa	cat	agt	ctg	aac	act	gtt	gca	gga	tgt	gcg	cta	gaa	act	gtg	acc	1200
Glu	His	Ser	Leu	Asn	Thr	Val	Ala	Gly	Cys	Ala	Leu	Glu	Thr	Val	Thr	
385					390					395					400	
gtc	gcg	cgc	ccc	gat	ctt	tta	gtt	ttg	gga	gcc	ttg	tac	cac	gac	att	1248
Val	Ala	Arg	Pro	Asp	Leu	Leu	Val	Leu	Gly	Ala	Leu	Tyr	His	Asp	Ile	
				405					410					415		
ggc	aag	ggc	ttc	ccg	cgt	cca	cac	gaa	caa	gta	ggt	gca	gag	atg	gtg	1296
Gly	Lys	Gly	Phe	Pro	Arg	Pro	His	Glu	Gln	Val	Gly	Ala	Glu	Met	Val	
			420					425					430			
gcg	agg	gcc	gcg	agc	cgc	atg	ggg	ttg	aac	ctt	cgc	gat	cgt	gcc	agc	1344
Ala	Arg	Ala	Ala	Ser	Arg	Met	Gly	Leu	Asn	Leu	Arg	Asp	Arg	Ala	Ser	
		435					440					445				
gtg	caa	acg	ctg	gtc	gcc	gag	cac	acc	gcg	gtg	gcc	aaa	atc	gcc	gcg	1392
Val	Gln	Thr	Leu	Val	Ala	Glu	His	Thr	Ala	Val	Ala	Lys	Ile	Ala	Ala	
	450					455					460					
cgc	ctt	gat	ccc	tcc	tcg	gag	ggc	gcc	gtc	gat	aag	ctg	ctt	gat	gct	1440
Arg	Leu	Asp	Pro	Ser	Ser	Glu	Gly	Ala	Val	Asp	Lys	Leu	Leu	Asp	Ala	
465					470					475					480	
gtt	agg	tat	gac	ctg	gtg	aca	ttg	aat	ctg	ctt	gag	gtg	cta	aca	gaa	1488
Val	Arg	Tyr	Asp	Leu	Val	Thr	Leu	Asn	Leu	Leu	Glu	Val	Leu	Thr	Glu	
				485					490					495		
gct	gat	gcg	aaa	gcc	acg	ggg	cct	ggc	gta	tgg	acg	gcg	cgt	ttg	gag	1536
Ala	Asp	Ala	Lys	Ala	Thr	Gly	Pro	Gly	Val	Trp	Thr	Ala	Arg	Leu	Glu	
			500					505					510			
cat	gcg	ctg	cgg	att	gtg	tgc	aag	cgt	gcg	cgt	gat	cgc	ctc	acc	gat	1584
His	Ala	Leu	Arg	Ile	Val	Cys	Lys	Arg	Ala	Arg	Asp	Arg	Leu	Thr	Asp	
			515				520					525				
att	cgc	ccg	gtt	gcg	ccg	atg	att	gcg	ccg	cgt	agc	gaa	att	ggg	ttg	1632
Ile	Arg	Pro	Val	Ala	Pro	Met	Ile	Ala	Pro	Arg	Ser	Glu	Ile	Gly	Leu	
	530					535					540					
gtg	gaa	cgc	gat	ggc	gtg	ttc	aca	gtg	caa	tgg	cac	ggc	gaa	gac	tta	1680
Val	Glu	Arg	Asp	Gly	Val	Phe	Thr	Val	Gln	Trp	His	Gly	Glu	Asp	Leu	
545					550					555					560	
cat	cgg	att	ctt	ggc	gta	att	tat	gcc	aaa	gga	tgg	aca	atc	acc	gcg	1728
His	Arg	Ile	Leu	Gly	Val	Ile	Tyr	Ala	Lys	Gly	Trp	Thr	Ile	Thr	Ala	
				565					570					575		
gcg	cgc	atg	ctg	gcc	aat	ggg	caa	tgg	agt	gcg	gaa	ttt	gat	gtc	cgc	1776
Ala	Arg	Met	Leu	Ala	Asn	Gly	Gln	Trp	Ser	Ala	Glu	Phe	Asp	Val	Arg	
			580					585					590			
gca	aac	ggc	ccc	caa	gat	ttt	gat	ccg	cag	cat	ttc	ctg	cag	gca	tat	1824
Ala	Asn	Gly	Pro	Gln	Asp	Phe	Asp	Pro	Gln	His	Phe	Leu	Gln	Ala	Tyr	
		595					600					605				
caa	tcc	ggg	gtg	ttt	tcc	gag	gtt	ccc	att	cca	gca	cct	ggg	ata	aca	1872
Gln	Ser	Gly	Val	Phe	Ser	Glu	Val	Pro	Ile	Pro	Ala	Pro	Gly	Ile	Thr	
	610					615					620					
gcc	aca	ttt	tgg	cac	ggg	aac	act	tta	gaa	gtg	cgc	act	gag	ctt	cgc	1920
Ala	Thr	Phe	Trp	His	Gly	Asn	Thr	Leu	Glu	Val	Arg	Thr	Glu	Leu	Arg	
625					630					635					640	
aca	gga	gct	att	ttt	gcc	ctg	ctc	aga	aca	ttg	ccc	gat	gcc	ctc	tgg	1968

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Thr	Gly	Ala	Ile	Phe	Ala	Leu	Leu	Arg	Thr	Leu	Pro	Asp	Ala	Leu	Trp	
				645					650					655		
atc	aac	gct	gtg	acc	cgc	ggg	gcg	acc	ctg	att	atc	cag	gca	gca	ctg	2016
Ile	Asn	Ala	Val	Thr	Arg	Gly	Ala	Thr	Leu	Ile	Ile	Gln	Ala	Ala	Leu	
			660					665					670			
aag	ccc	ggc	ttc	gat	cga	gca	acg	gtg	gaa	cgc	tcc	gta	gtc	agg	tcg	2064
Lys	Pro	Gly	Phe	Asp	Arg	Ala	Thr	Val	Glu	Arg	Ser	Val	Val	Arg	Ser	
		675					680					685				
ttg	gca	ggg	agc													2076
Leu	Ala	Gly	Ser													
	690															

<210> 24
 <211> 692
 <212> PRT
 <213> Brevibacterium lactofermentum

<400> 24

Met	Asn	Asn	Pro	Ala	Gln	Leu	Arg	Gln	Asp	Thr	Glu	Lys	Glu	Val	Leu	
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Ala	Leu	Leu	Gly	Ser	Leu	Val	Leu	Pro	Ala	Gly	Thr	Ala	Leu	Ala	Ala	
			20					25					30			
Thr	Gly	Ser	Leu	Ala	Arg	Ser	Glu	Leu	Thr	Pro	Tyr	Ser	Asp	Leu	Asp	
		35					40					45				
Leu	Ile	Leu	Ile	His	Pro	Pro	Gly	Ala	Thr	Pro	Asp	Gly	Val	Glu	Asp	
	50					55					60					
Leu	Trp	Tyr	Pro	Ile	Trp	Asp	Ala	Lys	Lys	Arg	Leu	Asp	Tyr	Ser	Val	
	65				70					75					80	
Arg	Thr	Pro	Asp	Glu	Cys	Val	Ala	Met	Ile	Ser	Ala	Asp	Ser	Thr	Ala	
			85						90					95		
Ala	Leu	Ala	Met	Leu	Asp	Leu	Arg	Phe	Ile	Ala	Gly	Asp	Glu	Asp	Leu	
			100					105					110			
Cys	Ala	Lys	Thr	Arg	Arg	Arg	Ile	Val	Glu	Lys	Trp	Arg	Gln	Glu	Leu	
		115					120					125				
Asn	Lys	Asn	Phe	Asp	Ala	Val	Val	Asp	Thr	Ala	Ile	Ala	Arg	Trp	Arg	
	130					135					140					
Arg	Ser	Gly	Pro	Val	Val	Ala	Met	Thr	Arg	Pro	Asp	Leu	Lys	His	Gly	
	145				150					155					160	
Arg	Gly	Gly	Leu	Arg	Asp	Phe	Glu	Leu	Ile	Lys	Ala	Leu	Ala	Leu	Gly	
			165					170						175		
His	Leu	Cys	Asn	Val	Pro	Gln	Leu	Asp	Thr	Gln	His	Gln	Leu	Leu	Leu	
			180					185					190			
Asp	Ala	Arg	Thr	Leu	Leu	His	Val	His	Ala	Arg	Arg	Ser	Arg	Asp	Val	
		195					200					205				
Leu	Asp	Pro	Glu	Phe	Ala	Val	Asp	Val	Ala	Met	Asp	Leu	Gly	Phe	Val	
	210					215					220					
Asp	Arg	Tyr	His	Leu	Gly	Arg	Glu	Ile	Ala	Asp	Ala	Ala	Arg	Ala	Ile	
	225				230					235					240	
Asp	Asp	Gly	Leu	Thr	Thr	Ala	Leu	Ala	Thr	Ala	Arg	Gly	Ile	Leu	Pro	
			245						250					255		
Arg	Arg	Thr	Gly	Phe	Ala	Phe	Arg	Asn	Ala	Ser	Arg	Arg	Pro	Leu	Asp	
		260						265					270			
Leu	Asp	Val	Val	Asp	Ala	Asn	Gly	Thr	Ile	Glu	Leu	Ser	Lys	Lys	Pro	
		275					280					285				
Asp	Leu	Asn	Asp	Pro	Ala	Leu	Pro	Leu	Arg	Val	Ala	Ala	Ala	Ala	Ala	

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290					295					300					
Thr	Thr	Gly	Leu	Pro	Val	Ala	Glu	Ser	Thr	Trp	Ala	Arg	Leu	Asn	Glu
305					310					315					320
Cys	Pro	Pro	Leu	Pro	Glu	Pro	Trp	Pro	Ala	Asn	Ala	Ala	Gly	Asp	Phe
				325					330					335	
Phe	Arg	Ile	Leu	Ser	Ser	Pro	Lys	Asn	Ser	Arg	Arg	Val	Val	Lys	Asn
			340					345					350		
Met	Asp	Arg	His	Gly	Leu	Trp	Ser	Arg	Phe	Val	Pro	Glu	Trp	Asp	Arg
	355						360					365			
Ile	Lys	Gly	Leu	Met	Pro	Arg	Glu	Pro	Ser	His	Ile	Ser	Thr	Ile	Asp
	370					375					380				
Glu	His	Ser	Leu	Asn	Thr	Val	Ala	Gly	Cys	Ala	Leu	Glu	Thr	Val	Thr
385					390					395					400
Val	Ala	Arg	Pro	Asp	Leu	Leu	Val	Leu	Gly	Ala	Leu	Tyr	His	Asp	Ile
				405					410					415	
Gly	Lys	Gly	Phe	Pro	Arg	Pro	His	Glu	Gln	Val	Gly	Ala	Glu	Met	Val
			420					425					430		
Ala	Arg	Ala	Ala	Ser	Arg	Met	Gly	Leu	Asn	Leu	Arg	Asp	Arg	Ala	Ser
		435					440					445			
Val	Gln	Thr	Leu	Val	Ala	Glu	His	Thr	Ala	Val	Ala	Lys	Ile	Ala	Ala
	450					455					460				
Arg	Leu	Asp	Pro	Ser	Ser	Glu	Gly	Ala	Val	Asp	Lys	Leu	Leu	Asp	Ala
465					470					475					480
Val	Arg	Tyr	Asp	Leu	Val	Thr	Leu	Asn	Leu	Leu	Glu	Val	Leu	Thr	Glu
				485					490					495	
Ala	Asp	Ala	Lys	Ala	Thr	Gly	Pro	Gly	Val	Trp	Thr	Ala	Arg	Leu	Glu
			500					505					510		
His	Ala	Leu	Arg	Ile	Val	Cys	Lys	Arg	Ala	Arg	Asp	Arg	Leu	Thr	Asp
	515						520					525			
Ile	Arg	Pro	Val	Ala	Pro	Met	Ile	Ala	Pro	Arg	Ser	Glu	Ile	Gly	Leu
	530					535					540				
Val	Glu	Arg	Asp	Gly	Val	Phe	Thr	Val	Gln	Trp	His	Gly	Glu	Asp	Leu
545					550					555					560
His	Arg	Ile	Leu	Gly	Val	Ile	Tyr	Ala	Lys	Gly	Trp	Thr	Ile	Thr	Ala
				565					570					575	
Ala	Arg	Met	Leu	Ala	Asn	Gly	Gln	Trp	Ser	Ala	Glu	Phe	Asp	Val	Arg
			580					585					590		
Ala	Asn	Gly	Pro	Gln	Asp	Phe	Asp	Pro	Gln	His	Phe	Leu	Gln	Ala	Tyr
	595						600					605			
Gln	Ser	Gly	Val	Phe	Ser	Glu	Val	Pro	Ile	Pro	Ala	Pro	Gly	Ile	Thr
	610					615					620				
Ala	Thr	Phe	Trp	His	Gly	Asn	Thr	Leu	Glu	Val	Arg	Thr	Glu	Leu	Arg
625					630					635					640
Thr	Gly	Ala	Ile	Phe	Ala	Leu	Leu	Arg	Thr	Leu	Pro	Asp	Ala	Leu	Trp
				645					650					655	
Ile	Asn	Ala	Val	Thr	Arg	Gly	Ala	Thr	Leu	Ile	Ile	Gln	Ala	Ala	Leu
			660					665					670		
Lys	Pro	Gly	Phe	Asp	Arg	Ala	Thr	Val	Glu	Arg	Ser	Val	Val	Arg	Ser
		675					680					685			
Leu	Ala	Gly	Ser												
	690														